Physics 310 Experimental Analysis Spring 2025

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Class Times: T/Th 8:30-11:30 (Trexler 263)
Office Hours: T/Th 2-3:30
(15-min appts at calendly.com/daniel_robb)

Course Description:
Laboratory experiments related to advanced and modern topics in physics. Data analysis, error propagation, and written and oral scientific presentation skills.

Textbook:
• *An Introduction to Error Analysis,* by Taylor, 2nd edition (1996), ISBN-13 9780935702750
(You may use the hardback 2nd edition if you like, I chose the paperback 2nd edition to reduce cost.)

Purpose of the Course:
You will learn about handling experimental data and experimental uncertainty in greater depth. Through four modules, one in each of the areas of our four upper-level elective courses (astrophysics, biophysics, physics of materials, and optics and spectroscopy), you will be introduced to the topics of the elective courses. In addition, you will learn to present the results of a scientific project effectively in both written and spoken formats.

Specific Goals of the Course:
1. to understand the principles and practices of handling experimental uncertainty
2. to be introduced to the topic areas of the upper-level elective courses at Roanoke
3. to practice skills of effective scientific writing and effective oral presentation of scientific results

Academic Integrity:
I will follow the college Academic Integrity policies, and you are responsible for knowing and following the college policies. You will be working in groups on course modules and may discuss challenging concepts or aspects of the modules with your group members and with me; however, your submitted reports should be your own work. Assigned homework problems may be discussed with others, but you should not take the entire solution process from a classmate. You may use generative AI as an aid for writing or for homework problems if you wish (be aware that currently generative AI is not always fully accurate on problem solutions), but you must acknowledge the use of generative AI on the assign, and the work you turn in must be fully your own. I am contractually obligated to report students if I suspect that they have engaged in academic dishonesty. Lastly, unless otherwise directed, cell phones should be silenced and out of sight during class periods.

Policy on Late Work:
It's important to be punctual in turning in your work, so that you can make use of prompt feedback. Each school day (M-F) that an assignment is late will result in a late deduction of 10%. As a result, assignments more than two weeks late cannot be accepted.

Methods of Instruction:
Doing careful and insightful laboratory work on meaningful physics questions is interesting, but also challenging. To tackle the challenge, we will spend the first part of the Thursday class each week learning about error analysis through lecture and worked examples, as well as assigned problems. The rest of the Thursday class, and the Tuesday class, each week is devoted to group work on the modules, which are guided projects in the areas of astrophysics, biophysics, materials, and optics/spectroscopy. To facilitate growth in written scientific communication, you will be provided with a sample lab report, as well as the rubric used for grading the module writeups. To assist with improvement in oral communication, the rubric used in evaluating final oral presentations will be shared. Assistance on the modules will be available from the instructor as well as other members of the Physics Group. You are encouraged to use office hours to discuss the material, especially if you are having trouble.

Attendance Policy:
Please note that if you are feeling ill, I ask that you inform me via email and not come to class, for your own health and out of consideration to other students in the class. Outside of illness, you are expected to attend every class. If you are going to be absent from class for a valid (excused) reason, I must be notified in advance, either in person or via email. Your fourth and each additional unexcused absence will result in a 2-point deduction in your final course grade. Furthermore, you are accountable for all work missed because of any absence. I will provide class materials for a missed class, but will not re-teach a missed class during office hours.

Make-up Tests:
If you miss a test, and have an official college excuse for that absence, then a make-up test can be arranged. If your test absence is unexcused, you will receive a zero on the test.

Use of Electronic Devices:
In class, you may use personal laptops, but only for course-related purposes. All other electronic devices must be turned off. On tests, you may use a scientific calculator; all other electronic devices must be turned off. Violation of this policy will be treated as a violation of the AI policy.

Feedback and Evaluation:
You should expect to receive a final grade of "A" for 93-100, an "A-" for 90-93, a "B+" for 87-90, a "B" for 83-87, etc. I may tweak final grades slightly based on the distribution of numerical grades and my perception of your effort in the course. These are the categories and percentages that will be used:

Mid-Term Exam:	15%	Final Exam (Oral Presentation):	15%
Classwork/Homework:	10%	Peer Review:	10%
Notebook:	10%	Module reports:	40%

The Mid-Term Exam will be given during class on the date indicated. *You will be given all needed equations on the exam,* though the equations will not be labeled.

Final exam (Oral Presentation): Oral presentation is a primary means of communicating scientific activity. You will choose one module to present to the class, which will serve as the final exam.

Classwork/homework will entail the working of problems from the Taylor textbook, both in class and at home, with the goal of understanding the handling of experimental uncertainty.

Peer review: You will be required to observe and evaluate one classmate's oral presentation (during the final exam period). You will be evaluated on the completeness and thoughtfulness of your review.

Notebook: It's a great practice to keep a journal of data, thoughts, and scientific ideas, since one can never be sure when creativity will reveal itself. You will be required in this course to keep such a journal. The journal will be evaluated for the continuity of effort shown in keeping the journal throughout the four modules you complete.

Written reports on modules: For each of the four modules, you will submit an individual report in a structured format including Abstract, Data/Calculations, Discussion, and Conclusion/Future Directions.

The Writing Center:

The Writing Center @ Roanoke College, located on the Lower Level of Fintel Library (Room 15), offers free tutorials focused on writing projects and oral presentations for students working in any field. Writers and presenters at all levels of competence may visit the Writing Center at any point in their process—including brainstorming, drafting, organizing, editing, or polishing presentation skills—to talk with trained peer tutors in informal, one-on-one sessions. The Writing Center is open Sunday through Thursday from 4 to 9 PM. Simply stop in, or schedule an appointment at www.roanoke.edu/writingcenter. Questions? Email writingcenter@roanoke.edu or call 540-375-4949.

Accessible Education Services (AES):

AES is located in the Goode-Pasfield Center for Learning and Teaching in **Fintel Library**. AES provides reasonable accommodations to students with documented disabilities. To register for services, students must self-identify to AES, complete the registration process, and provide current documentation of a disability along with recommendations from the qualified specialist. Please contact Dustin Persinger, Assistant Director of Academic Services for Accessible Education, at 540-375-2247 or by e-mail at aes@roanoke.edu to schedule an appointment. If you have registered with AES in the past and would like to receive academic accommodations for this semester, please contact Dustin Persinger at your earliest convenience to schedule an appointment and/or obtain your accommodation letter for the current semester.

Course schedule

#	Date	Schedule	Topic	Submission
1	Jan. 14	Rotation 1	Intro to course, Start work on Project 1	
2	16		Taylor Ch 1, work on Project 1	
3	21		Work on Project 1	
4	23		Taylor Ch 2, work on Project 1	
5	28		Work on Project 1	
6	30		Taylor Ch 2-3, work on Project 1	
7	Feb. 4		Work on Project 1	
8	6		Taylor Ch 3, work on Project 1	
	10			Project 1
9	11	Rotation 2	Work on Project 2	
10	13		Work on Project 2 (Dr. Robb out of town)	
11	18		Work on Project 2	
12	20		Taylor Ch 4, work on Project 2	
13	25		Work on Project 2	
14	27		Taylor Ch. 5, work on Project 2	
	28			Project 2
	Mar. 1-9		**SPRING BREAK**	
15	11	Rotation 3	Work on Project 3	
16	13		Taylor: Mid-Term Exam	
17	18		Work on Project 3	
18	20		Taylor Ch 6, work on Project 3	
19	25		Work on Project 3	
20	27		Taylor Ch 7, work on Project 3	
21	Apr. 1		Work on Project 3	
	2			Project 3
22	3	Rotation 4	Taylor Ch 9, work on Project 4	
23	8		Work on Project 4	
24	10		Taylor Ch 11, work on Project 4	
25	15		Work on Project 4	
26	17		Work on Project 4	
	21			Project 4
	26		Final presentations: 2:00–5:00 PM	

Note: You should expect to spend about 12 hrs/week on this course.